# CNS/ATM for Naval Aviation

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**Volume 1, Issue 3, June 1, 1999**

## Purpose

This newsletter provides information to the Naval aviation community concerning requirements and developments in Communications, Navigation and Surveillance / Air Traffic Management (CNS/ATM).

# NAVIGATION

## Protected ILS and FM Immunity

Although it is included as a capability required for CNS/ATM compliance, Protected Instrument Landing System **(P-ILS) is a SAFETY OF FLIGHT ISSUE** for operations in Europe stretching as far east as the Asian republics of the former Soviet Union.

In the early 1970s, before the advent of GPS, it appeared that widespread implementation of Microwave Landing Systems (MLS) would supplant ILS, thereby negating the need for the guard band of frequencies between commercial broadcasting and aviation needs. Sensing an untapped source of revenue, some nations pressed for the release of these guard bands.

In 1979, the World Radio Conference provided for the phase-out of the guard band adjacent to the VOR receiver band, and extended the upper end of the commercial FM broadcast band from 100.0 MHz to 107.9 MHz in Europe, Africa, the Middle East and the Soviet Union. In 1985, the International Civilian Aviation Organization (ICAO) Annex 10 was amended, to eliminate the previously protected bandwidth separation in Europe from 100.0 to 107.95 MHz and the VHF Navigation frequencies, which start at 108.1 MHz. In some nations starting as early as 1998, commercial broadcasters were authorized to establish broadcast stations in the broadcast spectrum adjacent to the VOR/ILS/VHF Aviation band or to increase power if already established. Many of the affected countries also allowed broadcasters to locate in close proximity to airfields.

ICAO completed a technical review that showed potential interference in some localities with the Localizer portion of the ILS (108.10-111.90 MHz). This is due to the containment envelope of the radiated power in conjunction with transmitter harmonics characteristics. The interference can cause a false heading reading, with no warning flag displayed to the pilot, while on final approach. For this reason, ICAO developed a new frequency immunity standard, in Annex 10, Sections 3.1.4 and 3.3.8, to protect receivers, and to ensure that all-weather operations using LOC/ILS can be maintained when the FM (commercial radio station) broadcast power is raised.

The SARPs (Annex 10, Vol. III, Part II) also require that VHF radios be protected from interference by VHF FM broadcast signals (FM Immunity). Eurocontrol's deadline coincides with the requirement for 8.33 kHz channel spacing (7 October 1999). This standard requires EMI/RFI hardening to provide the necessary FM Immunity. *FM immunity for the ARC-210 and other VHF capable receivers may be provided by adding an external filter.* The risk of interference on VHF radios is less of a flight safety issue since other voice channel frequencies are usually available.

In September 1994, a Special European Regional Air Navigation Meeting requested countries perform computer prediction modeling to determine the probability of interference, to identify areas where interference to non-protected receivers above the Annex 10 limits could occur, and to publish this information in their Aeronautical Information Publications. Nations were also to identify fields and runways where use of non-FM protected receivers for precision approach and landing systems would be restricted or even prohibited. This meeting authorized the co-existence of FM Immune and non FM-Immune aircraft until 1 January 2001. After that, all aircraft must be P-ILS equipped.

Each nation analyzed the airfields and broadcast stations within its own territorial borders, but not those of adjacent states. Europe consists of many sovereign nations with relatively small land territories. Therefore, there is uncertainty regarding statements indicating that no interference is predicted. Also as part of the analysis, each nation analyzed if their air fleets (both military and civil) would be affected. Although most nations indicated no interference, due to the relatively few platforms involved, the nations opted to modify their platforms to comply with ICAO standards.

At the present time, Austria is the only nation that reported interference as the result of its analysis (Vienna).

All European nations have agreed that they collectively will manage the FM interference problem only to the level required by FM immune-equipped aircraft. <u>All nations plan to require aircraft equipage by 1 Jan 2001.</u> Plans between now

and then are documented in ICAO Doc 6, as well as in numerous national publications (UK, France, Belgium and others). After January 2001, the nations have indicated they may issue NOTAMS regarding interference with ILS signals upon discovery. This is not considered likely to occur.

Exacerbating the problem is that in some nations (Italy, Greece, and Israel, for example), many unlicensed and unauthorized broadcast stations ("pirates") operate. These pirate stations, to evade local communication authorities, rapidly change locations and frequencies. The potential for near airfield transmitters and near localizer frequency transmissions is highly probable.

Germany issued a Class I NOTAM in December 1997 requiring all aircraft registered in Germany comply with FM immunity requirements for VOR and ILS receivers on 1 January 1998. For flights with non-immunized aircraft, the operator must insure that all related restrictions are followed. Germany indicated it will hold the aircrews/operators liable for any incident attributable to FM Immunity interference.

To comply with the mandates, there are several alternatives. Modifying existing VOR/ILS receivers provides a low up front cost (pro), but the cons of no growth capability, obsolescent equipment, and high support costs tend to make this the least favorable option. Rockwell Collins is manufacturing the R-2594/ARN-147, several variants of which contain EMI/RFI hardened FM-immune circuitry. Thus, replacement of current equipment with the ARN-147 with P-ILS is an alternative. The pros are moderate cost and a relatively modern hardware design, but the cons are no growth capability, and a large investment in equipment with a dated design. The third alternative is replacement with Multi Mode Receivers (MMRs) designed for the civil market. Rockwell Collins, Allied-Signal, and Thomson-CSF are among manufacturers offering MMRs. The pros are: the design is current, there is growth capability for adding circuit cards with MLS, civil GPS, and Joint Precision Approach Landing System (JPALS) in the future, and MMRs are TSO certified (important for aircraft seeking to retain residual commercial value), but the con is this is the highest up front cost choice. A fourth choice is replacement with a derivative civil MMR, which offers pros of current design, and growth capability, but will not be TSOed and has an unknown cost profile. The Air Force web site ( http://www.hanscom.af.mil/esc-gat/ ) has additional information.

One non-material alternative for aircraft without FM-Immunity is to use only PAR or TACAN-equipped military airfields in Europe. Most NATO airfields are equipped with TACAN and Precision Approach Radar (PAR) capabilities. However, this choice prevents aircraft from being able to use most civilian airfields in Europe as a weather alternate, seriously degrading their mission capability.

To summarize, in Europe there is potential interference with the localizer of ILS and for VHF communications due to commercial broadcasters which results in false headings or garbled communications; and European authorities have mandated a 1 January 2001 deadline for compliance with revised equipment standards for P-ILS and a 7 October 1999 date for VHF radios.

# CNS/ATM NEWS

## C-20 Implementation

One platform that has aggressively taken steps for P-ILS and FM Immunity compliance is the C-20. PMA-207 C-20 office reports that they chose off the shelf products from Rockwell Collins. The platforms have already

been equipped with P-ILS receivers. They further report that 8.33 kHz channel spacing radios (see Volume 1, Issue 1) have been received and the first is being installed on the C-20G based at Andrews AFB in the near future.

## CAA ADS-B Demonstration

On 10 July 1999, the Cargo Airlines Association (CAA), in conjunction with the FAA, is conducting a demonstration of Automatic Dependant Surveillance – Broadcast (ADS-B) technologies in the Ohio Valley. A **Navy P-3** based here at Pax will be participating in the demonstration. We expect to

get an early look at the military situational awareness utility of ADS-B, the limitations on candidate ADS-B datalinks, and human factors associated with implementation of ADS-B displays in the cockpit. Thanks to the PMA-290 Class Desk for it's assistance in using the P-3. ADS-B will be discussed in a future newsletter.